IV. Multiple Regression.

A. Introduction
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E. Properties of Estimators
F. Estimator for σ^2 and Variances for $\hat{\beta}s$
G. Inference in Multiple Regression
H. Goodness of Fit
I. Analysis of Variance

H. Goodness of Fit – R^2

1. Multiple Coefficient of Determination – R^2
2. Calculation – exactly the same.

   R^2 = ESS / TSS = 1 – (RSS / TSS)
3. Adjusted R^2:

$$\bar{R}^2 = 1 - \frac{RSS}{TSS}\left(\frac{n-1}{n-K-1}\right)$$

R^2 – used for assessing how well ***a model*** fits.
Adj. R^2 – used to ***compare two models***.
Same sample – same Y values.

Can the adjusted R^2 decrease?

3. Adjusted R^2:

$$\bar{R}^2 = 1 - \frac{RSS}{TSS}\left(\frac{n-1}{n-K-1}\right)$$

Adjusted R^2 decreases if you add irrelevant variables.

I. Analysis of Variance – F-tests.

1. Introduction:
   - R^2 – measures how much variation is explained by the regression.
   - Suppose $R^2 = 0.12$. The regression explains 12% of the variation in Y.
   - Is 12% a ***significant*** portion of the variation in Y?
   - ***F-tests***: statistical tests that ***determine whether the amount of variation explained is statistically significant.***

2. F-tests: Always compare two models.
   - Naïve Model:
   - Econometric Model:
   - Difference?
   - Hypothesis?

- Adding Independent variables, X_1, X_2, …X_K, allows us to ***explain variation in Y***.
  How much?
- Compare to the ***unexplained variation***.
  How much is left unexplained?
- The test statistic, an *F-statistic:*

- The test: compare F_{calc} to F_{α} :

  Choose α –

  Degrees of Freedom:

- Always a one-tail test:

3. Alternative F-test. Compare two regression models.
   - Two econometric models:
   - What is the hypothesis?
   - Calculated F-statistic:

F-Test: Is the ***Roses*** multiple regression better than the simple regression?

- The hypothesis:
- Calculate the F-statistic: